Art. XXI.—*Description of New and Rare Fossils obtained by Deep Boring in the Mallee.*

Part II.—Mollusca.

by

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(With Plates XXIV.–XXVIII.)

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MOLLUSCA.

Class PELECYPODA.

Fam. NUCULIDAE.

Genus NUCULA, Lamarck.

Nucula obliqua, Lamarck.

Nucula obliqua, Lamarck, 1819, Anim. sans Vert., vol. vi., pt. i., p. 59. Hedley, 1902, Mem. Austr. Mus. Sydney, No. iv., p. 292.

In the present borings *N. obliqua*, Lamarck is represented by some identifiable fragments and one perfect valve. The latter, together with numerous specimens in the Dennant collection, bears out our conclusion that in the oldest of our Tertiary beds the ancestors of the living species are represented by a more depressed shell, of thinner build, and more acute at the umbones; intermediate forms are found in the Janjukian series at Table Cape; whilst in the Kalimnan beds of Grange Burn and elsewhere, the same species had already attained characters seen in the living *N. obliqua*.

Distribution.—Bore 8, 165-180 feet, Bore 9, 254-256 feet.

Fam. LEDIDAE.

Genus LEDA, Schumacher.

LEDA HUTTONI, T. Woods.

Leda huttoni, T. Woods, 1878, Proc. Linn. Soc. N.S. Wales, vol. iii. pl. xxi. fig 2, Tate, 1886, Trans. R. Soc. S. Austr. vol. viii. p. 130, pl. vi. fig. 4.

A single, rather worn, but nevertheless undoubted valve of the above species occurs in the Mallee borings. In examining this specimen, together with numerous examples of *L. huttoni*, in the Dennant collection, we are struck with the close morphological affinities of his species with *L. lefroyi*, Beddome, living on the southern Australian coasts. It only materially differs from that species in the more regularly convex ventral margin and heavier dentition.

Distribution.—Bore 8, 165-180 feet.

Fam. PARALLELODONTIDAE.

Genus CUCULLAEA, Lamarck.

CUCULLAEA CORIOENSIS, McCoy.

Cucullaea corioensis, McCoy, 1876, Prod. Pal. Vict., dec. iii. p. 32, pl. xxvii., figs. 3, 4, 5*a*, *b*.

In the examination of some fragments of heavy examples we note a uniformity in the Mallee specimens, in that they show the transverse undulose ornament with the convexity on the radial ribs pointing towards the ventral margin. The two heaviest specimens figured by McCoy show the same feature, whilst the remainder and those from Muddy Creek in the Dennant collection exhibit a similar ornament, but with the undulations directed to the dorsal margin.

Distribution.—Bore 8, 199-204 feet. Bore 9, 263-273 feet; 315-325 feet.

Fam. ARCIDAE.

Genus LISSARCA, E. A. Smith.

LISSARCA RUBRICATA, Tate sp.

Limopsis rubricata, Tate, 1887, Trans. Roy. Soc. S. Austr., vol. ix., p. 71, pl. v., fig. 6.

Lissarca rubricata, Tate sp., Verco, 1907, Trans. Roy. Soc. S. Austr., vol. xxxi. p. 221, Gatliff and Gabriel, 1908, Proc. Roy. Soc. Vict. vol. xxi. (N.S.), pt. I. p. 390.

A typical valve of this species was found associated with fossils of a Kalimnan facies in the Mallee bore. The present specimen has been carefully compared with living examples from the Victorian coast, and found to be identical in the minutest particulars.

Distribution.—Bore 2, 198-200 feet.

Genus GLYCIMERIS, da Costa.

GLYCIMERIS MACCOYI, Johnston sp. (Plate XXIV., Figs. 1-5).

Pectunculus laticostatus, McCoy, non Quoy and Gaimard, 1875, Prod. Pal. Vict. dec. ii., p. 26, pl. xix., figs. 10-14.

P. M'Coyi, Johnston, 1885, Proc. R. Soc. Tas. for 1884, p. 199.

P. McCoyii, Johnston, Tate, 1886, Trans. R. Soc. S. Austr., vol. viii. p. 137.

From a lengthy and minute examination of numerous specimens of the above species from Balcombian, Janjukian and Kalimnan strata, we are able to make the following observations. The examples afford an interesting study of a series of mutations of one species through a comparatively long geological epoch, which species meantime preserves its essential characters.

1. The fossil specimens figured by McCoy under the name of *Pectunculus laticostatus*, Quoy and Gaimard, represent the tolerably distinct mutations (in Waagen's sense) of the one form. They are:—

Form *a*.—A small shell from Grice's Creek (Balcombian): length (ant.-post.), 14.75 mm.; height, 14 mm. (Pl. xxiv., fig. 1). Also larger valves from Corio Bay (Janjukian), length, 42.25 mm.; height, 42 mm. Characterised by 32 riblets in the small shell and by 34 riblets in the large one.

Form *b*.—A large and ponderous shell from Bird Rock (Janjukian): length, 64 mm.; height, 67 mm. Characterised by 40 riblets, practically equal to that of the recent *Glycimeris laticostatus*, Q. and G. (Pl. i. figs. 2, 3.)

2. The typical form of *G. maccoyi* diagnosed by R. M. Johnson has 29 riblets. (Pl. xxiv. f. 4.) His type form was described from the Table Cape beds (Janjukian); a similar form, but smaller, is found in the Balcombian of Mornington, Muddy Creek older beds, and the younger series at Corio Bay.

3. Accompanying the typical *G. maccoyi* at Table Cape (ex Atkinson coll. in the National Museum, Melbourne), are shells in every way comparable with the form approaching *G. laticostatus*, Q. and G., and figured by McCoy from Bird Rock. This we refer to form *b* (*antea*).

4. The several mutations of the above species show it to commence in the Balcombian as a moderate-sized shell with about 29 riblets, persisting into the Janjukian. Side by side with this form the mutation *b* springs up, but disappears before the Kalimnan.

5. The Kalimnan variant (form *c*) resembles the Balcombian (small var.) species, but is even smaller, and retains the Janjukian character of form *b* in having a more deeply concave umbonal cavity. (Pl. xxiv. fig. 5.) Its archaic character is seen in the number of its riblets, 26-30 (F.C. coll. in Nat. Mus. Melb. from MacDonald's, Muddy Creek).

6. The Bird Rock and Table Cape variant, form *b*, is clearly the Janjukian ancestor of *G. laticostatus*, Q. and G. (*forma vera*), which later on inhabited the Pliocene sea at Wanganui, and is now[1] confined to the area round New Zealand and the Chatham Islands. From *G. laticostatus*, Q. and G., the form *b* of Table Cape and Bird Rock differs in having a longer shell (ant.-post.) and a more finely striated ligamental area. (Pl. xxv. fig. 6.)

7. In the Kalimnan series *G. maccoyi* merges into *G. subtrigonalis*, Tate,[2] by the truncation of the anterior cardinal angle.

All the specimens of *G. maccoyi* from the Mallee bores belong to form *a*, having fewer riblets and moderate dimensions.

Distribution.—Bore 5, 162-163 feet; 175-189 feet. Bore 6, 158-161 feet. Bore 8, 165-180 feet; 199-204 feet; 204-210 feet. Bore 9, 254-256 feet.

Fam. TRIGONIIDAE.

Genus TRIGONIA, Bruguière.

TRIGONIA LAMARCKI, Gray. (Pl. XXV., Figs. 7-9).

Trigonia lamarckii, Gray, 1838, Ann. and Mag. Nat. Hist., vol. I., p. 482, Reeve, 1860, Conch. Icon. vol. xii. pl. i., figs 1*a-c*. T. Woods, 1888. (Journ. Roy. Soc. N.S. Wales, vol. xxii.), p. 163, pl. x. figs. 16, 17; pl. xiv. figs. 25, 26.

1. Typical examples of *G. laticostatus*, Q. and G. sp., from the Wanganui beds of N. Zealand, are in the Melbourne National Museum.

2. Trans. R. Soc. S. Austr., vol. viii. (for 1884-5), 1886, p. 137, pl. xi., figs. 6*a*, *b*.

A solitary example of the above species was found in the Mallee material. It is quite typical both in the costate ornament with blunt processes and in the heavy character of the shell. It is most interesting to meet with this species, which has not been recorded south of Port Jackson as a living shell, for it occurs here in presumably passage beds between the Janjukian and Kalimnan series of the Mallee.

A well-known Kalimnan offshoot of this polyphyletic form of *Trigonia* is seen in *T. howitti* McCoy, which has the same ornament (see pl. xxv. fig. 10), but is stouter, heavier and with fewer ribs; a form more adapted to shore conditions, as denoted by the fauna accompanying that shell.

Distribution.—Bore 9, 315-325 feet.

TRIGONIA MARGARITACEA, Lamarck, var. ACUTICOSTATA, McCoy.
(Pl. XXVI., Figs. 12 and 13*a*, *b*).

Trigonia acuticostata, McCoy, 1866, Geol. Mag. vol. iii. pp. 481, 482, fig. 1. Idem. 1875, Prod. Pal. Vict. dec. II., p. 21, pl. xix., figs. 1, 2. *T. margaritacea*, Lam. var. *acuticostata*, McCoy, Hedley, 1902, Mem. Austr. Mus., Mem. IV. pt. 5, p. 301, figs. 47, 48.

McCoy, in his original description of the above fossil, alludes to the distinction between this variant of *T. margaritacea*, Lam. and the species, *T. lamarcki*, Gray, and *T. pectinata*, Lam. (=*T. margaritacea*) in having a "remarkable compression of the ribs into acute angular ridges; and from the same cause the spinous tubercles do not form the broad, blunt, transverse tubercles which they do in the recent species, in which latter the ridges form broad, obtusely flattened, almost square ribs when viewed from the margin in a position in which those of the present species form a series of acute angles."[1]

That this distinction is only varietal has already been pointed out by Mr. Hedley (loc. supra cit. p. 301), who is not followed in this, however, by Messrs. Pritchard and Gatliff.[2] The fossil examples correspond with the living *T. margaritacea* (see pl. xxv. fig. 11), in having a lighter and less inflated shell as compared with *T. lamarcki;* also in being more oblique and having more acute ribs. It is never found lower than the Kalimnan series (Lower Pliocene) in the geological scale.

1. Loc. cit., 1875, p. 22.

2. Proc. Roy. Soc. Victoria, vol. xvi. (n.s.), pt. i., 1904, pp. 235-237. See also Pritchard, Vict. Nat., vol. xxiii., w. 6, 1906, p. 118.

The recent examples of *T. margaritacea*, var. *acuticostata* from Bass Strait determined by McCoy have all the requisite characters of the fossil variety, and specimens in the Dennant collection from Jemmy's Point exactly resemble them in the fewer number of ribs. (See pl. xxvi. figs. 13*a*, *b*.

T. margaritacea has been recorded from the Werrikooian (Pleistocene) of Limestone Creek, Glenelg River, by Mr. J. Dennant.[1] On referring to the Dennant collection, however, we find the only specimen of *Trigonia* from Limestone Creek there represented belongs to *T. lamarcki*.

A variety of *T. margaritacea*, in which the scales of the ribs are flattened out in an almost spatulate fashion, has lately been described by Dr. J. C. Verco, from St. Vincent's Gulf, and elsewhere along the South Australian shores, to which he gives the varietal name, *bednalli*.[2]

Distribution.—Bore 2, 198-200 feet. Bore 3, 226 feet. Bore 6, 154-158 feet; 158-161 feet. Bore 9, 315-325 feet. Bore 10, 230-254 feet; 254-296 feet.

Fam. PECTINIDAE.

Genus PECTEN, Müller.

Pecten murrayanus, Tate.

Pecten murrayanus. Tate, 1886, Trans. R. Soc. S. Aust., vol. viii. p. 105, pl. vii. figs. 5*a*, *b*.

This species affords an interesting illustration of the close relationship between many of our Tertiary species of mollusca and those now living, generally in lower latitudes, around the Australian coast and in the adjacent seas. *P. murrayanus* is clearly a progenitor of the group of pectens represented by *P. leopardus* Reeve[3] (W. and N. Australia and New Caledonia); *P. solaris*, Born sp.[4] (China Seas and Amboyna); and *P. kuhnholtzi*, Bernardi[5] (New Caledonia). In all four species, the costation and concentric ornament are precisely identical, if a fairly extensive series is taken. A constant character in all is shown in the crowding of the concentric lamellae near the umbonal region, their opening out

1. Rec. Geol. Surv. Vict., vol. i., pt. ii., 1903, p. 146.
2. Trans. Roy. Soc. S. Austr., vol. xxxi., 1907, p. 224, pl. xxviii., figs. 1-3.
3. Icon. Conch, 1852, pl. xxxii., fig. 145.
4. Index Mus. Caes. Vind., 1778, pt. i., Testacea, pl. vi., fig. 4. See also Sowerby, Thes. Conch. 1842, pt. ii., p. 55, pl. xii., figs. 7, 8, 22.
5. Journ. de Conch., 1863, vol. viii., p. 378, pl. xiii., fig. 1.

in the medium area, and dense condition repeated in the ventral area. The above conclusions have been arrived at after a prolonged study of the living shells above noted.

Distribution.—Bore 1, 215-244 feet. Bore 3, 226 feet. Bore 4, 163-170 feet. Bore 5, 162-163 feet; 175-189 feet.

Fam. MYTILIDAE.

Genus ARCOPERNA, Conrad.

ARCOPERNA SCAPHA, Verco. (Pl. XXVII., Fig. 16).

Arcoperna scapha, Verco, 1908, Trans. Roy. Soc. S. Aust. vol. xxxii. p. 196, pl. xii. figs. 1-5.

Observations.—A typical example of this species, in no wise differing from the living form, occurs in the present series. It is the first recorded occurrence of this genus as an Australian fossil. The species is well-known as a recent form by Dr. Verco's published description; that author recording it from Beachport at 49 to 200 fathoms; off Cape Jaffa, 90 and 130 fathoms; off Cape Borda, 55 fathoms; and east of Neptunes, 45 fathoms, all in S. Australia. Dr. Verco's record of Mr. Hedley's report of the species in New South Wales is 22 miles east of Narrabeen, at 80 fathoms. One of us (C.J.G.) has obtained it off Wilson's Promontory.

In the Dennant collection specimens labelled "*Verticordia* sp." can be referred to this genus. They are from Brown's Creek, Spring Creek and Hamilton Creek, Janjukian localities which may be on the same or a lower horizon than the present specimen which is associated with a mixed Kalimnan and Janjukian fauna. The shells from the undoubted Janjukian localities mentioned, differ however, in the stronger decussate surface ornament and rough growth-lines, and probably represent another species.

Distribution.—Bore 3, 226 feet.

Fam. CRASSATELLITIDAE.

Genus CRASSATELLITES, Kruger.

CRASSATELLITES KINGICOLOIDES, Pritchard.

Crassatellites kingicoloides, Pritchard, 1902, Proc. Roy. Soc. Vict., vol. xv. (N.S.) pt. i. p. 94, pl. xiii. figs. 1-3. IV. pt. 5, p. 315, woodcut, fig. 55.

Up to the present this species has only been recorded from the Gippsland Lakes Tertiary deposits at Jemmy's Point, It has, how-

ever, been identified by us in the Nat. Mus. collection from Beaumaris.

In the Mallee borings the species is fairly abundant at the Kalimnan horizon, associated with such typical fossils as *Limopsis beaumariensis*, Chapm. and *Bathyactis beaumariensis*, Dennant.

A point worthy of special remark is the absence from the boring material in the Mallee, of the allied form, *Crassatellites camurus*, Pritchard[1]; a species which was described from the Western District of Victoria (Grange Burn and McDonald's, near Hamilton), and, so far as we know, has not occurred elsewhere. This alliance of the fauna with the Jemmy's Point facies of the Kalimnan, rather than with that of the shallow-water facies of the Hamilton District (Upper beds), is further borne out by the occurrence in the Mallee of *Turritella pagodula*, a common Jemmy's Point fossil.

Even in fragments it is tolerably easy to distinguish *C. kingicoloides* from *C. camurus* by the relatively greater depth in the former of the posterior adductor impression, and, what is even more striking, the large, deep and broad lunule and its transversely striated character as compared with *C. camurus*.

Distribution.—Bore 1, 208-210 feet. Bore 2, 198-200 feet. Bore 3, 226 feet. Bore 4, 163-170 feet. Bore 5, 155-159 feet; 175-189 feet. Bore 6, 154-158 feet. Bore 8, 199-204 feet; 204-210 feet. Bore 9, 263-273 feet; 315-325 feet. Bore 10, 254-296 feet; 310-320 feet.

Genus CUNA, Hedley.

Cuna concentrica, Hedley.

Cuna concentrica, Hedley, 1902, Mem. Austr. Mus., Mem. iv. pt. 5, p. 315, woodcut, fig. 55.

The above species, first described by Mr. Hedley from shells found in dredgings off the coast of New South Wales, shows certain variations within limits; but the chief characters are so distinct that there is no difficulty in matching it with our fossils from the Mallee bores at the Kalimnan horizon (L. Pliocene).

The living specimens have been recorded from Port Kembla, 63-75 fathoms, by C. Hedley; and from Balmoral Beach, shore-line, by one of us (C.J.G.). Both localities are in N.S. Wales.

Cuna edentata, Verco,[2] living in the Gulf of St. Vincent, S Australia, resembles the above species in both fossil and recent

1. Loc. supra cit., 1902, p. 96, pl. xiv., figs. 5-9.
2. Trans. Roy. Soc. S. Austr., vol. xxxii., 1908, p. 357, pl. xiv., figs. 1-3.

examples, with the distinction, however, that the denticulations on the inner ventral border in *C. concentrica* are wanting in Verco's species.

Distribution.—Bore 8, 204-210 feet. Bore 9, 263-273 feet. Bore 11, 175-197 feet; 197-199 feet.

Fam. CONDYLOCARDIIDAE.

Genus CONDYLOCARDIA, Bernard.

Condylocardia tenuicostae, sp. nov. (Pl. XXVII., Figs. 17*a-c*).

Description.—Shell very small, shining, of a cream colour. Ovate wedge-shaped, inequilateral; inflated at the umbonal region and depressed towards the ventral. Dorsal margin straight; anterior end tapering and bluntly rounded at the ventral angle; posterior end short and widely rounded towards the ventral. Interior of shell smooth, with feeble muscular impressions; ventral edge on the commissure bearing a series of minute depressions and elevations, passing into thin, diminishing riblets within.

External surface sculpture consisting of about 36 narrow, depressed or sub-acute riblets, slightly varying in strength and dying out before reaching the umbonal area; crossed at irregular intervals by several well-marked concentric growth-lines.

Cardinal border, short, straight, Left valve with a strong bifid, median cardinal tooth, and feeble anterior and posterior lateral teeth; right valve with a triangular anterior cardinal, behind which is a deep fossa for the median cardinal of the left valve.

Prodissoconch smooth, subovate, slightly salient post-ventrally; umbonal aspect depressed.

Dimensions.—Holotype (left valve) from Bore 10, 310-320 feet. Length, 2.15 mm.; height, 1.77 mm.

Observations.—This species is a very distinct form. It shows some relationship to *Condylocardia pectinata*, Tate and May sp.[1] in its general form and hingement, but in that species the ornament is a coarse radial ribbing instead of fine costulations, as in *C. tenuicostae*.

Distribution.—Bore 8, 225-226 feet. Bore 10, 186-190 feet; 225-230 feet (paratype); 310-320 feet (holotype). Bore 11, 175-197 feet; 197-199 feet.

1. *Carditella pectinata*, Tate and May, Trans. Roy. Soc. S. Austr., vol. xxiv., 1900, p. 103. Proc. Linn. Soc. N. S. Wales, vol. xxvi., 1901, p. 435, pl. xxvii., figs. 96, 97. See also Hedley, Rec. Austr. Mus., vol. vii., No. 2, 1908, pl. xxv., figs. 43-45.

Fam. CARDITIDAE.

Genus CARDITA, Brubudière.

Cardita calva, Tate. (Plate XXVII., Fig. 18).

Cardita calva, Tate, 1887, Trans. Roy. Soc. S. Austr., vol. ix. p. 189, pl. xx. fig. 14.

This species is not found below the Kalimnan series. As Tate remarks, it is nearest allied to *C. compacta*, but is distinguished by the smooth umbones, and it also slightly differs in shape.

C. calva is very abundant in the younger beds in the Mallee bores, and shows a surprising amount of variability in the surface ornament. One of the extreme forms is now figured, in which the cancellate ornament, produced by the crossing of the concentrics by the radials is confined to a narrow strip on the posterior margin.

This species is found graduating into *Cardita dilecta*, var. *excelsior*, Verco,[1] a living Australian form; some specimens of the fossils matching it so closely as to be inseparable.

Distribution.—Bore 1, 215-244 feet. Bore 3, 201-220 feet; 226 feet. Bore 5, 163-175 feet. Bore 6, 114-150 feet; 158-161 feet. Bore 8, 165-180 feet; 210-219 feet. Bore 9, 254-256 feet; 263-273 feet; 315-325 feet. Bore 10, 230-254 feet. Bore 11, 197-199 feet.

Cardita spinulosa, Tate.

Cardita spinulosa, Tate, 1886, Trans. Roy. Soc. S. Aust., vol. viii. p. 153, pl. ii. fig. 3.

This species is evidently very closely related to *Carditella torresi*, E. A. Smith,[2] which, by the way, according to that author, is not typical of the genus *Carditella*, in its ligamental characters.[3] The only difference between the recent species quoted and our fossil specimens appear to be in the lighter hinge area of the living form.

Cardita spinulosa, Tate, is represented in the bore by small specimens of the normal subrotund shape of the neanic examples, as distinguished from the ventrally truncated forms in the gerontic stage.

Distribution.—Bore 3, 226 feet. Bore 6, 158-161 feet. Bore 10, 310-320 feet.

1. *Venericardia dilecta*, E. A. Smith, var. *excelsior*, Verco, Trans. Roy. Soc. S. Austr., vol. xxxii., 1908, p. 348, pl. xiv., fig. 9. *Cardita calva*, Tate. Gatliff and Gabriel, Proc. Roy. Soc. Victoria, vol. xxv. (n.s.), pt. i., 1912, p. 173.

2. Rep. Chall. Zool., vol. xiii., Lamellibranchiata, p. 217, pl. xv., figs. 8, 8a.

3. Loc. supra cit., p. 218.

Fam. LEPTONIDAE.

Genus ROCHEFORTIA, Velain.

ROCHEFORTIA DONACIFORMIS, Angas sp.

Mysella donaciformis, Angas, 1878, Proc. Zool. Lond., p. 863, pl. liv. fig. 13.

Rochefortia donaciformis, Angas, sp., Dall, 1900, Trans. Wagner Inst., vol. iii. pt. 5, p. 1157. Hedley, 1902, Proc. Linn. Soc. N.S. Wales, vol. xxviii. pt. i. p. 7, pl. i. figs. 10-14.

This species is recorded as living on the coasts of Victoria, Tasmania and N.S. Wales. Our specimens are identical in all essential points of shape, ornament and hingement, with the recent specimens.

Distribution.—Bore 11, 542-544 feet; 544-546 feet.

Genus ERYCINA, Lamarck.

ERYCINA MICANS, Tate sp.

Kellia micans, Tate, 1887, Trans. Roy. Soc. Vict., vol. ix. p. 148, pl. xix. fig. 13.

This common Kalimnan fossil is generically related to the living Erycinas of the Australian coast. It closely approaches *Kellia angasiana*, Tate,[1] a form which may eventually find its place in the above genus, from which it differs in the stronger cardinal dentition and usually present concentric ornament.

In Kellia the hinge is lighter and the shell non-punctate. The shell in Lepton is typically more depressed and the hingement is slighter.

The living *Erycina parva*, Deshayes,[2] has a similar shell, but with a more convex ventral border; the valve-surface, moreover, is conspicuously pitted instead of microscopically so, as in *E. micans*. The dentition is identical with that of *E. micans*.

The related *E. parva* has been found fossil in the Pliocene of Wanganui, N. Zealand, by R. Murdoch,[3] and as a living species is found in New Zealand, Victoria and N.S. Wales.

1. Trans. Roy. Soc. S. Austr., vol. ix. (1886), 1887, p. 68, pl. v., fig. 7.

2. *Kellia parva*, Deshayes, Proc. Zool. Soc. Lond., 1855, p. 182. *Erycina acupuncta*, Hedley, Mem. Austr. Mus., No. iv., pt. 5, 1902, p. 321, woodcut fig. 60. *Erycina parva*, Desh. sp., Hedley Trans. N. Z. Inst., vol. xxxviii., 1905, p. 73.

3. See Hedley, loc. supra cit., p. 74.

Distribution.—Bore 6, 114-150 feet. Bore 7, 142 feet 3 inches-155 feet. Bore 10, 225-230 feet; 310-320 feet. Bore 11, 197-199 feet

Fam. DONACIDAE.

Genus DONAX, Linné.

DONAX KENYONIANA,[1] sp. nov. (Pl. XXVII., Figs. 19*a*, *b*, 20 and 21.)

Description.—Shell, triangularly elongate-ovate, very inequilateral, the anterior extremity being much larger than the posterior; depressed convex, flattened towards the ventral and anterior, and with a distinct depressed area on the ventral behind the median line; ventral margin nearly straight, incurved near the keel; antero-ventral angle well rounded, posterior sub-angulate; umbonal keel elevated and sharp. Surface of shell with purple and cream colour-bands in well preserved specimens. Growth-lines conspicuously marked, crossed by fine, radial striae, stronger towards the posterior. Interior of shell smooth, with the commissure raised within and flattened towards the outer margin, in clean specimens closely and finely vertically striated.

Dimensions.—Length of holotype (medium-sized example), 12 mm.; height, 7.75 mm. Length of a larger specimen, paratype, 33.75 mm. Shell sometimes attaining a length of about 33 mm.

Observations.—The above species differs from *Donax depressa*, Tate,[2] a Murray cliffs fossil, in its more elongate form and striated inner margin. In the latter character it resembles *D. deltoides*, Lamarck,[3] a species still living on the Victorian coast, but from which it is at once separated by its greater length and thinner build.

Distribution.—Bore 7, 142 feet, 3 inches-155 feet. Bore 8, 160-165 feet; 165-180 feet. Bore 10, 186-190 feet; 195-225 feet; 225-230 feet; 310-320 feet.

Fam. CORBULIDAE.

Genus CORBULA, Lamarck.

CORBULA COXI, Pilsbry.

Corbula coxi, Pilsbry, 1897, Proc. Acad. Nat. Sci. Philad., p. 363, pl. ix. figs. 1-3. *C. scaphoides*, Dennant and Kitson, non Hinds, 1903, Rec. Geol. Surv. Vict., vol. i. pt. 2, p. 139. *C. coxi*, Pilsbry, Gatliff and Gabriel, 1909, Proc. Roy. Soc. Vict., vol. xxii. (N.S.) pt. i. p. 44.

1. Named after Mr. A. S. Kenyon, of the State Rivers and Water Supply Commission.
2. Trans. R. Soc. S. Austr., vol. ix., 1887, p. 168, pl. xvi., fig. 11.
3. Anim. sans Vert. (ed. Deshayes), vol. vi., 1819, p. 241. Pritchard and Gatliff, Proc. R. Soc. Vict., vol. xvi. (N.S.) pt. i., 1903, p. 118.

In working out the several species of *Corbula* occurring in the Mallee bores, it was discovered that a discrepancy exists regarding the identity of the Kalimnan species found at Grange Burn and other localities, which has hitherto been referred to Hinds' species *C. scaphoides*. The latter species, a figure of which is given in the Challenger Report,[1] is, however, a high, strongly umbonate form with deep sulci, generally comparable with *C. ephamilla*, Tate,[2] but not so heavily structured.

One of us (C.J.G.), in writing to Mr. E. A. Smith, of the British Museum, has had the benefit of that gentleman's dictum regarding the Victorian species, *C. coxi*, Pilsbry, which Mr. Smith recognised amongst specimens sent to him, and which he compared with typical specimens in the British Museum (Nat. History), London. These specimens have been carefully studied in comparison with some of ours from the Mallee bores, which show them to be identical; and at the same time agreeing with specimens in the Dennant collection from the Victorian Kalimnan, determined by that author as *C. scaphoides*, Hinds.

Distribution.—Bore 1, 215-244 feet. Bore 3, 266 feet. Bore 4, 163-170 feet. Bore 5, 155-159 feet; 163-175 feet; 175-189 feet. Bore 6, 114-150 feet; 158-161 feet. Bore 8, 165-180 feet; 180-199 feet; 204-210 feet; 210-219 feet. Bore 9, 254-256 feet; 263-273 feet; 315-325 feet. Bore 10, 160-186 feet; 186-190 feet; 225-230 feet; 230-254 feet; 254-296 feet; 310-320 feet.

Corbula ephamilla, Tate.

Corbula ephamilla, Tate, 1887, Trans. Roy. Soc. S. Aust. ol. ix. p. 176, pl. xii. figs. 13*a*, *b*, 14.

In the course of diagnosing the differential characters of the *Corbulae* in the Mallee borings, the close relationship of *C. tunicata*, Hinds,[3] to the above species was very apparent. The only difference being the usually heavy, incrassate character of the shell cavity of the anterior area.

The true *C. scaphoides*, Hinds,[4] is also extremely close, both in shape and ornament, when the adult shells are compared; the chief

1. Hinds, Proc. Zool. Soc. Lond., pt. xi., 1843, p. 56. E. A. Smith, Rep. Chall., Zool. vol. xiii., pt. xxxv., 1885, p. 32, pl. vii., figs. 3, 3*a*, 3*b*.
2. Trans. Roy. Soc. S. Austr., vol. ix., 1887, p. 176, pl. xvii., figs. 13*a*, *b*, 14.
3. Proc. Zool. Soc. Lond., 1843, p. 55.
4. Cf. E. A. Smith, loc. supra cit.

differences being the usually heavy and thickened structure of the shell in *Corbula ephamilla*, along with the greater attenuation of its anterior.

Distribution.—Bore 1, 208-210 feet. Bore 3, 226 feet. Bore 4, 163-170 feet. Bore 5, 155-159 feet; 162-163 feet; 175-189 feet. Bore 6, 114-150 feet; 150-154 feet; 154-158 feet; 158-161 feet. Bore 7, 142 feet 3 inches-155 feet. Bore 8, 165-180 feet; 180-199 feet; 199-204 feet; 204-210 feet; 210-219 feet. Bore 9, 254-256 feet; 263-273 feet; 315-325 feet. Bore 10, 220 feet; 254-296 feet; 310-320 feet. Bore 11, 199,209 feet.

Class SCAPHOPODA.

Fam. DENTALIIDAE.

Genus DENTALIUM, Linné.

Dentalium aratum, Tate.

Dentalium aratum, Tate, 1887, Trans. Roy. Soc. S. Austr., vol. ix. p. 192, pl. xx. fig. 8, Idem, ibid., 1889, vol. xxiii. p. 265.

A critical examination of the recent related forms of the above genus has resulted in the following conclusions:—The Australian *Dentaliidae* form a large group, the characters of which show a great amount of variation. *D. aratum* is no exception, and the species most likely to be confused with that form are the living *D. robustum*, Brazier,[1] *D. intercalatum*, Gould,[2] and *D. francisense*, Verco.[3] *D. robustum* can be separated by the absence of longitudinal striae. A constant feature of the costation in *D. intercalatum* is in the ribs becoming distinctly rounded in later growth. In the case of *D. francisense* we agree with Verco, who remarks, "I am inclined to think that even this species is but an extreme variant of the *D. intercalatum*, Gould."

Distribution.—Bore 1, 215-244 feet. Bore 3, 226 feet.

1. Proc. Linn. Soc. N.S. Wales, vol. ii., 1877, p. 56. Hedley Rec. Austr. Mus., vol. iv., No. 3, 1901, p. 128, pl. xvii., fig. 32.
2. Proc. Bost. Soc. Nat. Hist., vol. vii., 1859, p. 166. Sowerby in Reeve's Icon. Conch, vol xviii., 1872, pl. vii., fig. 45.
3. Trans. Roy. Soc. S. Austr., vol. xxxv., 1911, p. 207, pl. xxvi., figs. 1, 1*a*.

Fam. SIPHONODENTALIIDAE.

Genus CADULUS, Philippi.

Cadulus acuminatus, Tate.

Cadulus acuminatus, Tate, 1887, Trans. Roy. Soc. S. Aust., vol. ix. (for 1885), p. 194. Idem, 1899, ibid., vol. xxiii. (for 1898-9), p. 266, pl. viii. fig. 12.

Observations.—This species is separated from *C. infans*[1] by some slight characters, which are nevertheless constant. It is an interesting point with regard to the above species that as a fossil, *C. acuminatus* is confined to the Lower Pliocene (Kalimnan) or "Oyster beds" of Aldinga, whilst *C. infans* is only found at Muddy Creek, in beds of the same age. This is an additional proof of the relationship of the Mallee Cainozoic marine fauna with the rest of the Murray Gulf occurrences, for the Hamilton Kalimnan sea appears to have been partially shut off from the former by the porphyry and granite cliffs of south-western Victoria.

C. acuminatus is found living around the coasts of New South Wales, Victoria and South Australia.

Distribution.—Bore 11, 175-199 feet.

Class GASTEROPODA.

Fam. DELPHINULIDAE.

Genus LIOTIA, Gray.

Liotia dennanti, sp. nov. (Plate XXVII., Figs. 22, 23).

Description.—In form somewhat trochoid, consisting of four whorls; the first two somewhat depressed with a slightly discernible fine medium keel, becoming more pronounced in the third and fourth whorls; the last whorl subangulate, with a narrow, subangular median and basal keel. Sutures excavated. The area between the keels depressed or gently concave, the surface crossed with fine, curved threads. Surface of each whorl immediately below the suture faintly nodulose.

Dimensions.—Height, 3.5 mm.; greatest diameter, 4.5 mm.

Affinities.—This species appears to be nearest allied to the living *Liotia mayana*, Tate.[2] It essentially differs from that species, how-

1. Tate, Trans. Roy. Soc. S. Austr., vol. xxiii., 1899, p. 266, pl. viii., fig. 11.
2. Trans. Roy. Soc. S. Austr., vol. xxiii., 1899, p. 227, pl. vi., figs. 5*a-c*.

ever, in its more trochoid form, in the stronger thread-like surface ornament, and in the excavated sutures.

Observations.—A well preserved but aberrant or distorted variant of this species occurs in the Dennant Collection (Nat. Museum), from the Lower beds of Muddy Creek (Balcombian).

Distribution.—Bore 8, 180-199 feet.

Fam. TROCHIDAE.

Genus EUCHELUS, Philippi.

Euchelus baccatus, Menke sp. (Plate XXVI., Fig. 14).

Monodonta baccata, Menke, 1843, Moll. Nov. Holl., p. 14, No. 5.

Euchelus baccatus, Menke, sp., Tryon, 1889, Man. Conch., p. 435, pl. lxii. figs. 72, 73.

Observation.—The Mallee example appears at first sight to have a neater and more concise ornament than fresh shells of this living species. The difference, however, appears to be more apparent than real, and produced by the process of fossilisation. In the characters of the beaded spirals, the obliquely interstriated areas and the absence of a true umbilicus, it agrees with the somewhat variable species *E. baccatus*. The fossil specimen here occurs in a mixed Janjukian and Kalimnan fauna, but the shell is probably of the latter age.

Distribution.—Bore 5, 175-189 feet.

Genus CLANCULUS, Montfort.

Clanculus sp., aff. aloysii, T. Woods.

Clanculus aloysii, T. Woods, 1876, Proc. R. Soc. Tas., p. 155. *Trochus* (*Clanculus*) *aloysii*, T. Woods sp., Tryon, 1889, Man. Conch., vol. xi. p. 59, pl. xiv. figs. 20-23.

Observations.—A specimen in the neanic stage occurs in one of the bores, the ornament of which is clearly that of a *Clanculus*. In its subacute liration and interstriate areas, it most nearly resembles the above species. *C. aloysii* is a common living Australian species.

Distribution.—Bore 3, 201-220 feet.

Fam. UMBONIIDAE.

Genus TEINOSTOMA, H. and A. Adams.

Teinostoma depressula, sp. nov. (Pl. XXVII., Figs. 24*a*, *b*).

Description.—Shell depressed convex; on apical face sutures flush with surface. Periphery rounded. Umbilicus filled in with a callus, but the area is distinctly concave. Aperture subovate. Surface polished, and under a high power finely striated with growth-lines.

Dimensions.—Greatest diameter, 1.84 mm.; height, .75 mm.

Observations.—The above species occurs in three samples of strata in Bore No. 10, all of which contain a Kalimnan fauna, and therefore the horizon of the species is definitely known.

Distribution.—Bore 10, 186-190 feet; 195-225 feet; 225-250 feet.

Teinostoma pulcherrima, sp. nov. (Pl. XXVII., Figs. 25*a-c*).

Description.—Apical aspect naticoid, depressed; whorls rapidly widening, consisting of three coils. Lower side depressed, and concave in the umbilical area; umbilicus only partially filled with callus. Surface marked with fine, but definitely incised growth-lines, which under a high power are seen to be crossed by fine sulcate markings, giving the surface a highly ornate appearance. Aperture sub-quadrate.

Dimensions.—Greatest diameter, 4.75 mm. Height, 1.75 mm.

Observations.—The above species is an aberrant form of *Teinostoma*, and on account of the partially open umbilicus might eventually find a place in Cossmann's genus *Bonnetia*.[1]

A second specimen was found in the borings in the Mallee, but not figured. It belongs to the same specific type, but shows a slight variation in having the sutures of the whorls on the apical side more excavate and the whorls themselves less rapidly increasing in width. The surface ornament is identical, whilst the aperture is of the same general form, but more roundly ovate, owing to the narrower terminal whorl, and the umbilicus is slightly more open.

Affinities.—There appear to be no fossil or living representatives of this form of shell closely approaching it in all characters, perhaps the nearest being the living *Teinostoma orbitum*, Hedley.[2]

1. Annales Soc. Roy. Zool. et Malac. Belg., vol. xli., 1906, p. 207. (Genotype figured on pl. ix., fig. 16 ter-1).

2. Proc. Linn. Soc. N. S. Wales, vol. xxv., 1900, pt. i., p. 96, figs. B 15.

of Port Darwin and Torres Strait. The living species has a thinner lip and stronger spiral surface-markings.

Distribution.—Bore 3, 201-220 feet (var.). Bore 10, 225-230 feet (Holotype.)

Genus CYCLOSTREMA, Marryatt.

Cyclostrema homalon, Verco.

Cyclostrema homalon, Verco, 1907, Trans. R. Soc. S. Austr. vol. xxxi. p. 305, pl. xxix. figs 3, 4. Gatliff and Gabriel, 1913, Proc. Roy. Soc. Vict., vol. xxvi. (N.S.), pt. I., p. 75.

Observations.—This is a living species on the South Australian and Victorian coasts. It is distinguished from Petterd's earlier described *Cyclostrema harriettae*, which also occurs in the borings, by its wider umbilicus and coarser spiral markings.

Some examples of *Cyclostrema* in the Dennant collection (Nat. Museum) from Guerard's Hill (Janjukian), and from the Gippsland Lakes (Kalimnan), if not identical with the above species, are closely allied to it.

The present occurrence is from a Kalimnan horizon.

Distribution.—Bore 10, 195-225 feet.

Cyclostrema harriettae, Petterd.

Cyclostrema harriettae, Petterd, 1884, Journ. Conch., p. 141, No. 24. Tate and May, 1901, Proc. Linn. Soc. N.S. Wales, vol. xxvi. pt. 3, p. 396, pl. xxv. figs. 46-48.

Observations.—This species, like the preceding, is here recorded as a fossil for the first time, and it is interesting to note its occurrence as far down as the Kalimnan. Its undoubted relation to the form separated by Dr. Verco as *C. homalon* is also demonstrated in the fossil specimens, and the two forms occur on the same stratigraphical platform.

C. harriettae is a living species on the Victorian and Tasmanian coasts.

Distribution.—Bore 6, 114-150 feet.

Fam. EULIMIDAE.

Genus EULIMA, Risso.

Eulima pinguicula, sp. nov. (Pl. XXVII., Fig. 26).

Description.—Shell pyramidal, (?) subacute at apex; whorls seven, the earlier ones subdepressed, gradually becoming more convex, the last being rather swollen. Sutures well marked. Aperture long-ovate, with a thin callosity on the columellar margin. Surface polished.

Dimensions.—Length (circ.), 5.5 mm. Width (circ.), 2 mm.

Observations.—Four specimens of this rather distinct species were found at one horizon in one of the Bores. It has a larger aperture than *E. danae*, T. Woods,[1] whilst the whorls are more convex, and the apex is less acute.

The living species, *Eulima inflata*, Tate and May,[2] of Tasmania and Victoria, is a shorter shell with a more circular aperture; otherwise it bears some resemblance to the above species.

Distribution.—Bore 10, 225-230 feet.

Fam. PYRAMIDELLIDAE.

Genus PYRAMIDELLA, Lamarck.

Pyramidella jonesiana, Tate sp.

Odontostomia (*Syrnola*) *jonesiana*, Tate, 1898, Trans. R. Soc. S. Austr., vol. xxii. p. 70; p. 82 (fig.)

Pyramidella jonesiana, Tate sp. Pritchard and Gatliff, 1900, Proc. R. Soc. Vict., vol. XIII (N.S.), pt. I. p. 147.

Observations.—The above species was first described by Professor Tate from fossil specimens (Werrikooian) from the Tintinara Bore, S. Australia.

P. jonesiana is related to *P. tincta*, Angas sp.,[3] another recent Victorian species, but is distinguished from the latter by its greater breadth.

It is noteworthy that this is another living species occurring also in the Cainozoic strata of Victoria and S. Australia. It is found

1. Proc. Linn. Soc. N. S. Wales, vol. iv., 1880, p. 2, pl. i., fig. 1.

2. Trans. R. Soc. S. Austr., vol. xxiv., 1900, p. 95. Proc. Linn. Soc. N. S. Wales, vol. xxvi., 1901, pt. 3, p. 381, pl. xxv., fig. 58.

3. Proc. Zool. Soc. Lond., 1871, p. 15, pl. i., fig. 11.

both in the Werrikooian (Upper Pliocene) and the underlying Kalimnan (Lower Pliocene) in the Mallee Bores.

The distribution of the living examples is Flinders and Western-port, Victoria.

Distribution.—Bore 1, 215-244 feet. Bore 6, 114-150 feet. Bore 10, 160-186 feet; 186-190 feet; 195-225 feet; 225-230 feet. Bore 11, 197-199 feet.

Genus TURBONILLA, Risso.

Turbonilla weeahensis,[1] sp. nov. (Pl. XXVIII., Figs. 27*a*, *b*).

Description.—Shell turreted, moderately elongate. Holotype with eight flattened whorls and a heterostrophe apex; whorls slightly concave below the sutures. Aperture subquadrate, lip thin. Surface of shell with about 24 shallow, sinuate sulci on each whorl. Sutures well marked. The shell-surface between the sulci finely striate, longitudinally.

Dimensions.—Height of holotype, 7.25 mm. Greatest width, 2.5 mm.

Distribution.—Bore 10, 225-230 feet; 310-320 feet.

Fam. CAPULIDAE.

Genus CALYPTRAEA, Lamarck.

Calyptraea kalimnae, sp. nov. (Pl. XXVIII., Figs. 28*a-c*, 29).

Description.—Shell of thick substance, sub-circular in basal outline. Spire excentric; apex slightly exsert. Sutures well marked, whorls slightly to gently convex, marked by growth lines, corrugations and striae, except on the first two whorls, which are smooth. Base marked by sinuous growth-lines. Umbilical region with a callus and very small perforation.

Dimensions.—Major diameter of holotype (from Dennant coll.), 10 mm. Height, 6.5 mm. Diameter of a typical specimen from the Mallee Bore, 4 mm.

Observations.—The above species is represented by a large number of immature examples in the Mallee bores. They all occur on the Kalimnan horizon. Since they are undeveloped specimens it has been considered necessary to select as a holotype of the species a fine example from the Dennant collection (labelled *Calyptraea* sp.) from the Gippsland Lakes.

1. Name derived from Co. Weeah in which the bores are situated.

Affinities.—*C. kalimnae* is undoubtedly closely allied to *C. placuna*, Tate,[1] from the Aldinga Cliffs and the Adelaide Bore, S. Australia. It differs, however, from that species in its incrassate type of shell, more evenly convex whorls, thicker carinate edge and sub-circular rather than circular outline.

Distribution.—Bore 5, 155-159 feet. Bore 6, 114-150 feet. Bore 8, 165-180 feet; 204-210 feet. Bore 9, 254-256 feet; 256-263 feet; 263-273 feet; 315-325 feet. Bore 10, 186-190 feet; 254-296 feet.

Fam. NATICIDAE.

Genus NATICA, Lamarck.

NATICA SUBINFUNDIBULUM, var. CRASSA, Tate.
(Pl. XXVI., Figs. 15*a*, *b*).

Natica subinfundibulum, var. *crassa*, Tate, 1893, Trans. R. Soc. S. Austr., vol. xvii. pt. 327.

Observations.—Tate refers to this variety as "distinguished simply by its thick test and usually larger size, attaining to 20 mm. in length and width." The size of present specimen is considerably greater than that given by Prof. Tate, having a length of 50 mm. and a width of 52 mm. It was fortunately jammed in the convolutions of the shell auger, and so escaped comminution. This variety, *crassa*, has been found in both the lower and upper beds of Muddy Creek (Balcombian and Kalimnan), and at Beaumaris (Kalimnan). In the present case the associated fossils indicate a Kalimnan age for the horizon of this variety.

Distribution.—Bore 10, 220 feet.

Fam. RISSOIDAE.

Genus RISSOA, Fréminville.

RISSOA GATLIFFIANA, sp. nov. (Pl. XXVIII., Fig. 30).

Description.—Shell minute, conical and subelongate; moderately thick and polished. Whorls four; depressed convex, excepting the body whorl; the last two whorls ornamented with closely-set, fine, spiral incised lirae, about 24 on body whorl. Suture well marked. Apical whorl flattened. Aperture ovate, lip protracted behind, where its margin is dehiscent from the body whorl; laminate internally.

Dimensions.—Length, 2.3 mm.; greatest width, 1.15 mm.

1. Trans. R. Soc. S. Austr., vol. xvii., pt. 2, 1893, p. 331, pl. vii., fig. 4.

Observations.—This very distinct little *Rissoa* does not seem to be matched or even approached by any other form, living or fossil, at any rate in Australian faunas. We take the opportunity of naming the species after our friend Mr. J. H. Gatliff, who has worked so assiduously amongst the gasteropod fauna of the Victorian coast.

Distribution.—Bore 10, 225-230 feet, four specimens).

Sub-genus ONOBA, H. and A. Adams.

Rissoa (Onoba) bassiana, Hedley. (Pl. XXVIII., Fig. 31).

Onoba bassiana, Hedley, 1911, Zool. Results, F.I.S. "Endeavour," Part I., p. 108, pl. xix. fig. 25.

Observations.—This species was lately described by Mr. Hedley from off Devonport, Tasmania (depth unrecorded), and it is also known from Port Albert, Victoria (Gatliff and Gabriel). It is interesting to meet with this additional example of a species which, whilst occurring in the Kalimnan of the old Murray Gulf, still remains in evidence as a component of the living molluscan fauna of Bass Strait. The fossil example here figured has a length of 5 mm., whilst Hedley's type measures 4.5 mm.

Distribution.—Bore 6, 158-161 feet. Bore 8, 165-180 feet; 180-199 feet; 204-210 feet. Bore 9, 315-325 feet.

Rissoa (Onoba) chrysalida, sp. nov. (Pl. XXVIII., Figs. 32, 33).

Description.—Shell pupiform, stoutly built, polished. Whorls four, depressed convex, with a spiral or helicoid apex of two and a half turns. Sutures shallow, excavated. Aperture circular, lip thick. Faint colour bands parallel with and near to the sutures are seen in some specimens. Under a high magnification surface marked with fine growth lines.

Dimensions.—Length, 3.1 mm.; greatest width, 1.5 mm.

Observations.—This neat little shell is a characteristic fossil of the Kalimnan series in Victoria. It is a rather variable form in regard to the height of the whorls, and an extreme variety from the Dennant coll. is here figured, in addition to the central type form. The same shell was named in MS. by Mr. J. Dennant as *R. chrysalida*, and in the Dennant collection (Nat. Museum) there are numerous examples collected from the upper beds of Muddy Creek.

Distribution.—Bore 8, 165-180 feet; 180-199 feet; 204-210 feet; 210-219 feet. Bore 9, 254-256 feet. Bore 10, 254-296 feet.

Fam. TURRITELLIDAE.

Genus TURRITELLA, Lamarck.

Turritella circumligata, Verco.

Turritella circumligata, Verco, 1910, Trans. R. Soc. S. Austr., vol. xxxiv. p. 123, pl. xxx. figs. 3. 4.

Observations.—The two individuals found in the bore have been compared with living specimens received from Dr. Verco, obtained off Beachport, S. Australia, at 110 fathoms. They are separable from the thickly corded varieties of *T. tristira*, Tate,[1] by having two heavy ligae, the anterior of which is generally separated into three by deeply incised spiral furrows, the central division being the thickest. The surface of the spiral cords is marked with fine oblique striae.

Distribution.—Bore 3, 226 feet.

Turritella pagodula, Tate.

Turritella pagodula, Tate, 1893, Trans. R. Soc. S. Austr., vol. xvii. pt. 2, p. 336, pl. viii. fig. 10.

Observations.—This species has hitherto been recorded from three localities of the Kalimnan series, viz., Gippsland Lakes, Beaumaris and Horsham. It is absent from the Hamilton beds, but occurs in some abundance in the Mallee bores, thus pointing to the isolation of the former locality in Lower Pliocene times from the Great Murray Gulf area, which had direct connection with the Port Philip and Bairnsdale Kalimnan shore-line. The Mallee specimens are typical.

Distribution.—Bore 4, 163-170 feet. Bore 5, 155-159 feet; 163-175 feet; 175-189 feet. Bore 6, 114-150 feet. Bore 8, 165-180 feet; 180-199 feet; 204-210 feet; 225-226 feet. Bore 9, 254-256 feet; 315-325 feet.

Fam. CERITHIIDAE.

Genus CERITHIUM, Bruguière.

Cerithium torrii, Tate.

Cerithium torrii, Tate, 1899, Trans. R. Soc. S. Austr., vol. xxiii. p. 109, pl. I. fig. 2.

Observations.—A partially pyritised specimen occurs in this series. In places the shell still remains intact, and shows the

1. Trans. Roy. Soc. S. Austr., vol. xvii., 1893, p. 338, pl. viii., fig. 8; pl. x., fig. 3.

"closely and minutely reticulate-lined" surface characteristic of this species. The general form of the shell is near *C. pritchardi*, Harris,[1] but the whorls are flattened and the costate ornament occupies the whole height of each turn.

C. torrii was first described by Prof. Tate from material obtained at the bottom of a deep well at Tareena on the Murray, in New South Wales, just across the Victorian border.

Distribution.—Bore 5, 162-168 feet.

Fam. CASSIDIDAE.

Genus CASSIS, Lamarck.

Cassis contusus, Tate.

Cassis contusus, Tate, 1899, Trans. R. Soc. S. Austr., vol. xxiii. p. 108, pl. I. figs. 1*a*, *b*.

Observations.—A fragment of this species was found in the Mallee bores. The contused markings arranged in three spiral rows round the body whorl are a characteristic feature in this species. It was originally described, like the preceding species, from a well-boring at Tareena, on the Murray, in New South Wales.

Distribution.—Bore 2, 198-200 feet.

Sub-genus SEMICASSIS (Klein), Mörch.

Cassis (Semicassis) subgranosa, Tate sp.

Semicassis subgranosa, Tate, 1889, Trans. R. Soc. S. Austr., vol. xi. p. 166, pl. vii. fig. 10.

Observations.—This rare species is distinguished from *C.* (*S.*) *semigranosa* by the stronger costate ornament and the spirally sulcated body whorl.

The only locality hitherto yielding this species is Edithburg, Yorke's Peninsula, S. Australia, where it occurs in the "hard raggy limestones."

Distribution.—Bore 6, 154-158 feet.

1. Cat. Tert. Mollusca, Australasia (Brit. Mus.), 1897, p. 226, pl. vii., fig. 3.

Fam. BUCCINIDAE.

Genus NASSA, Martini.

Nassa spiraliscabra, sp. nov. (Pl. XXVIII, Fig. 34).

Description.—Shell long—ovate, with a sharply pointed apex. Whorls below the apex four to five, depressed, and slightly concave in the posterior third; apex of three and a-half smooth whorls. Surface ornament consisting of moderately thin costae, becoming beaded towards the suture. Body whorl more inflated, and spirally scratched by fine grooves, which pass across the longitudinal ribs; the spiral grooves less conspicuous on the earlier whorls. Sutures deeply excavated; whorls tabulate. Outer lip with external marginal varix; internally with feeble denticulae. Columellar area with a moderately broad callosity, anteriorly denticulate.

Dimensions.—Height of holotype, 10.5 mm.; greatest width, 5.25 mm.

Affinities and Observations.—The nearest related form to the above species is *Nassa labecula*, Adams,[1] From that form it differs, however, in its longer or more turreted shell and a less extent of callus on the inner lip, and more numerous ribs.

N. spiraliscabra is associated with distinctive Kalimnan species in the samples present.

Distribution.—Bore 6, 114-150 feet. Bore 8, 199-204 feet.

Fam. VOLUTIDAE.

Genus MARGINELLA, Lamarck.

Marginella hordeacea, Tate.

Marginella hordeacea, Tate, 1878, Trans. R. Soc. S. Austr., vol. I., p. 91.

Observations.—The Mallee specimens are not so broadly ovate as those from the type locality of Tate, namely, Aldinga, S. Australia. Examples of the shell in the Dennant coll. (Nat. Mus.) show, however, that the species varies in the same locality, but in different proportions. For instance, in the Kalimnan of Muddy Creek the majority of shells are broadly ovate, and a few ovate; from Aldinga, of two specimens in the collection named, one is narrowly ovate, the other broad; and from the Gippsland Lakes they are nearly all broad forms. The spire is not so exsert as in *M. praeformicula*,

1. Proc. Zool. Soc. Lond., 1851, p. 98. Reeve, Conch. Icon., vol. viii., 1855, pl. xxv., fig. 166.

next described, and the shell is smooth; otherwise it somewhat resembles that species in general contour and in the arrangement of the plaits.

Distribution.—Bore 10, 225-230 feet.

MARGINELLA PRAEFORMICULA, sp. nov. (Pl. XXVIII., Fig. 35).

Description.—Shell of medium size, volutiform, of solid build. Spire of medium length, conspicuously exserted. Whorls four, convex, and with about ten sharp plications on the shoulder of the body whorl. Sutures with a flattened, depressed area. Aperture long, sinuous and expanded anteriorly. On the dorsal aspect of the shell the lip margin is limbate, or thickened with a varix. Columellar plaits four, the anterior large and oblique, the two posterior small and transverse.

Dimensions.—Length, 8.5 mm.; greatest width, 5 mm.

Affinities.—The nearest form to the above species is the living Australian *Marginella formicula*, Lamarck.[1] In that shell, however, the plicae are more numerous and less acute; the whorls are more tabulate; the outer lip less expanded posteriorly; and the number of whorls five, against four in *M. praeformicula*. The fossil species foreshadows all the characters of the above-mentioned living form so closely that there can be little question of its being ancestrally related.

Distribution.—Bore 3, 201-220 feet; 226 feet. Bore 5, 155-159 feet; 175-189 feet. Bore 6, 114-150 feet; 158-161 feet. Bore 7, 142 feet 3 inches-155 feet. Bore 8, 165-180 feet; 180-199 feet; 199-204 feet. Bore 9, 315-325 feet.

Fam. TEREBRIDAE.

Genus TEREBRA, Lamarck.

TEREBRA PROFUNDA,[2] sp. nov. (Pl. XXVIII., Fig. 36).

Description.—Shell cerithioid, elongate, consisting of nine broad, convex whorls and a protoconch of two and a-half whorls. Longitudinal costae nine on each whorl, subacute and transversely scored by fine sulcose lines, eight on the penultimate whorl. Surface of whorls posteriorly depressed concave, anteriorly convex. Sutures deeply impressed. Aperture subquadrate.

Dimensions.—Length, 10.75 mm.; greatest with, 3.25 mm.

Distribution.—Bore 10, 225-230 feet.

1. Anim. sans Vert., vol. x., 1822, p. 441. Reeve, Conch. Icon., vol. xv., 1864, pl. viii. figs. 28*a*, *b*.

2. That is, obtained by deep boring.

Fam. PLEUROTOMIDAE.

Genus PLEUROTOMA, Lamarck.

Sub-genus DRILLIA, Gray.

PLEUROTOMA (DRILLIA) DILECTOIDES, sp. nov. (Pl. XXVIII., Fig. 37).

Description.—Shell of medium size for the sub-genus, solid, fusiform with an acute apex. Shoulder sloping, base contracted, with a short canal. Whorls of the spire bicarinate; the body whorl with above five ridges, becoming weaker anteriorly. Apex acuminate, of three smooth whorls, seven whorls to the spire. Interspaces of carinae covered with closely-set thread-like and sigmoidal striae. Aperture with a moderately deep sinus, long, ovate and obliquely set.

Dimensions.—Holotype from Dennant coll. Length, 12 mm.; greatest width, 5 mm.

Observations.—The Mallee specimens being incomplete, it was necessary to select a fine example from an extensive series in the Dennant coll. (Nat. Mus.), from the Kalimnan of the Gippsland Lakes. These specimens were named in MS. by the late Mr. J. Dennant, F.G.S., as "*Drillia cochlearis.*" That species name, however, has been used in an allied genus, and we therefore rename it as *P.* (*D.*) *dilectoides*, in reference to its undoubted affinities to *Drillia dilecta*, Hedley.[1] The latter species, from moderately shallow water (24-75 fathoms) in the neighbourhood of Port Jackson, is separated, however, by its blunt apex, flatter sides, and longer and more vertical aperture.

Distribution.—Bore 6, 114-150 feet; 158-161 feet. Bore 8, 180-199 feet.

EXPLANATION OF PLATES.

PLATE XXIV.

Fig. 1.—*Glycimeris maccoyi*, Johnston sp. Form *a*, with 32 riblets. Balcombian series. Grice's Creek, Port Phillip. Coll. W. Kershaw. Nat. size.

1. Mem. Austr. Mus., Mem. iv., pt. vi., 1903. (Sci. Results of Trawling Exped., "Thetis"), p. 387, fig. 100.

Fig. 2.—*G. maccoyi*, Johnston sp. Form *b* (=*Pectunculus laticostatus*, McCoy, non Q. and G.), with about 40 riblets. Janjukian series. From McCoy's type locality, Bird Rock Cliffs, Torquay. Coll. J. F. Bailey. Nat. size.

3.—*G. maccoyi*, Johnston sp. Interior of valve showing finely striated area. Janjukian series. Bird Rock, Torquay. Geol. Surv. Vict. coll. Nat. size.

4.—*G. maccoyi*, Johnston sp. Specimen with 29 riblets. Janjukian series. Table Cape, Tasmania. Nat. size.

5.—*G. maccoyi*, Johnston sp. Form *c*, with 30 riblets. Kalimnan series. Macdonald's, Muddy Creek. Coll. F. Chapman. Nat. size.

Plate XXV.

Fig. 6.—*Glycimeris laticostatus*, Quoy and Gaimard sp. Living. Coast of New Zealand. This species has about 40 riblets. Interior of valve to show the comparatively coarsely striate area. Nat. size.

7.—*Trigonia lamarcki*, Gray. Mallee Bore, No. 9, 315-325 feet. Nat. size.

8.—*T. lamarcki*, Gray. Living. Coast of New South Wales. For comparison with the above fossil. Nat. size.

9.—*T. lamarcki*, *Gray*. Costation of living specimen, magnified, × 7.

10.—*T. howitti*, McCoy. Costation magnified for comparison with the preceding figure. Cainozoic (Kalimnan series). Macdonald's, Muddy Creek. Dennant coll. × 7.

11.—*T. margaritacea*, Lamarck. Living example. Bass Strait. Nat. size.

Plate XXVI.

Fig 12.—*Trigonia margaritacea*, var. *acuticostata*, McCoy. Cotype of *T. acuticostata*, McCoy. Cainozoic (Kalimnan series). Beaumaris, Port Philip. Nat. size.

13*a*, *b*.—*T. margaritacea*, var. *acuticostata*, McCoy. Living example (2 valves). Bass Strait. Pres. by Capt. Stanley. Nat size.

14.—*Euchelus baccatus*, Menke sp. Oral aspect. Mallee Bore, No. 5, 175-189 feet. Nat. size.

15*a*, *b*.—*Natica subinfundibulum*, var. *crassa*, Tate. *a*, dorsal aspect; *b*, oral aspect; Mallee Bore, No. 10, 220 feet. Nat. size.

PLATE XXVII.

Fig. 16.—*Arcoperna scapha*, Verco. Mallee Bore, No. 3, 226 feet. × 4.

17*a-c*.—*Condylocardia tenuicostae*, sp. nov. *a*, exterior of left valve, × 13; *b*, cardinal area of left valve, × 26; *c*, cardinal area of right valve, × 26; *a* and *b*, Holotype. Mallee Bore, No. 10, 310-320 feet; *c*, Mallee Bore, No. 10, 225-230 feet.

18.—*Cardita calva*, Tate. An extreme variety with costation suppressed and concentrics dominant. Mallee Bore, No. 9, 254-256 feet, × 6.

19*a*, *b*.—*Donax kenyoniana*, sp. nov. Holotype, *a*, right valve × 2; *b*, portion of the same to show colour bands and radial striae; × 4. Mallee Bore, No. 10, 310-320 feet.

20.—*D. kenyoniana*, sp. nov. Paratype. Interior of left valve. Mallee Bore, No. 8, 160-165 feet. Nat. size.

21.—*D. kenyoniana*, sp. nov. Paratype. Ventral edge of valve interior. Mallee Bore, No. 10, 186-190 feet. × 8.

22.—*Liotia dennanti*, sp. nov. Holotype. Oral aspect. Mallee Bore, No. 8, 180-199 feet. × 4.

23.—*L. dennanti*, sp. nov. Paratype. Portion of shell more highly magnified to show intercostal, thread-like ornament. Cainozoic (Balcombian series). Lower beds, Muddy Creek. Ex. Dennant Coll. × 8.

24*a*, *b*.—*Teinostoma depressula*, sp. nov. Holotype. *a*, apical aspect; *b*, umbilical aspect. Mallee Bore, No. 10, 225-230 feet. × 8.

25*a-c*.—*Teinostoma pulcherrima*, sp. nov. Holotype. *a*, apical aspect, × 4; *b*, umbilical aspect, × 4; *c*, surface ornament, × 12. Mallee Bore, No. 10, 225-230 feet.

26.—*Eulima pinguicula*, sp. nov. Holotype. Mallee Bore, No. 10, 225-230 feet. × 8.

PLATE XXVIII

Fig. 27*a*, *b*.—*Turbonilla weeahensis*, sp. nov. Holotype, *a*, oral aspect, × 4; *b*, protoconch, × 26. Mallee Bore, No. 10, 225-230 feet.

Fig. 28*a-c.*—*Calyptraea kalimnae*, sp. nov. Holotype. *a*, apical aspect; *b*, lateral aspect; *c*, umbilical aspect. Cainozoic (Kalimnan series). Gippsland Lakes (ex. Dennant Coll.) × 2.

29.—*C. kalimnae*, sp. nov. Paratype. One of the typically small forms from the Mallee Bores (No. 8, 165-180 feet). × 2.

30.—*Rissoa gatliffiana*, sp. nov. Holotype. Mallee Bore, No. No. 10, 225-230 feet. × 20.

31.—*Rissoa* (*Onoba*) *bassiana*, Hedley. Mallee Bore, No. 8, 180-199 feet. × 8.

32.—*Rissoa* (*Onoba*) *chrysalida*, sp. nov. Holotype. Typical form. Mallee Bore, No. 9, 254-256 feet. × 8.

33.—*Rissoa* (*O.*) *chrysalida*, sp. nov. Paratype. Extreme, elongate form. Cainozioc (Kalimnan series). Upper beds, Muddy Creek. Ex. Dennant Coll. × 8.

34.—*Nassa spiraliscabra*, sp. nov. Holotype. Mallee Bore, No. 8, 199-204 feet. × 4.

35.—*Marginella praeformicula*, sp. nov. Holotype. Mallee Bore, No. 8, 180-199 feet. × 4.

36.—*Terebra profunda*, sp. nov. Holotype. Mallee Bore, No. 10, 225-230 feet. × 4.

37.—*Pleurotoma* (*Drillia*) *dilectoides*, sp. nov. Holotype. Cainozoic (Kalimnan series). Gippsland Lakes. Ex. Dennant coll. × 4.